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(54) Title: THE USE OF BACTERIAL PHAGE ASSOCIATED LYSING ENZYMES FOR TREATING VARIOUS ILLNESSES

(57) Abstract: A composition and method for treating bacterial infections is disclosed which comprises the treatment of an individual with an effective amount of at least one lytic enzyme produced by a bacteria infected with a bacteriophage specific for said bacteria wherein at least one lytic enzyme is selected from the group consisting of shuffled lytic enzymes, chimeric lytic enzymes, holin enzymes, and combinations thereof. A carrier may be used for delivering the lytic enzyme. This method, and composition can be used for the treatment of upper respiratory infections, skin infections, wounds, and burns, vaginal infections, eye infections, intestinal disorders and dental problems.

AMENDED CLAIMS
[received by the International Bureau on 29 January 2002 (29.01.02);
original claims 1-151 replaced by amended claims 1-41 (7 pages)]

1. A method for treating bacterial infection, comprising the steps:

a) obtaining a composition comprising an effective amount of at least one lytic enzyme wherein the lytic enzyme is coded for by a bacteriophage specific for a specific bacteria causing the bacterial infection and the lytic enzyme is selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes and combinations thereof; and

b) applying the composition to a site of the infection.

2. The method of claim 1, wherein the method for treating bacterial infections comprises the prophylactic treatment of infections.

3. The method of claim 1, wherein the method for treating bacterial infections comprises the therapeutic treatment of infections.

4. The method of claim 1, wherein the method further comprises including at least one holin protein in the composition.

5. The method of claim 4, wherein the at least one holin protein is selected from the group consisting of chimeric holin lytic protein and shuffled lytic protein.

6. The method of claim 1, wherein the composition further comprises at least one antibiotic that potentiates the bactericidal activity of the lytic enzyme.

7. The method of claim 1, further comprising a non recombinant lytic enzyme

8. The method of claim 1, further comprising delivering the at least one lytic enzyme in a carrier suitable for delivering the lytic enzyme to the site of the infection.

9. The method of claim 1, wherein the at least one lytic enzyme is active against a bacterium selected from the group consisting of *Pseudomonas, Streptococcus*

pneumoniae, Streptococcus fasciae, Listeria, Salmonella, E. coli, Campylobacter, Helicobacter pylori, Pseudomonas, Streptococcus mutans, Mycobacterium tuberculosis and Streptococcus.

10. The method of claim 1, wherein the carrier is selected from the group consisting of an inhalant, a topical cream, a nasal spray, a syrup, a tablet, tampon, a suppository, an eye drop solution, a candy, a chewing gum, a lozenge, a troche, a powder, an aerosol, a liquid, a liquid spray, a bandage, a toothpaste and an oral wash.

11. A composition for the treatment of a bacterial infection of an upper respiratory tract, prepared by a process comprising the steps of:

a) obtaining at least one lytic enzyme coded for by a bacteriophage specific for a bacteria causing the bacterial infection, the at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria; and

b) admixing the at least one lytic enzyme with a carrier suitable for delivery to a mouth, throat, or nasal passage.

12. The composition of claim 11, wherein the carrier is selected from the group consisting of a candy, chewing gum, lozenge, troche, tablet, a powder, an aerosol, a liquid and a liquid spray.

13. A composition for the treatment of a bacterial infection of the digestive tract, prepared by a process comprising the steps of:

a) obtaining at least one lytic enzyme wherein the at least one lytic enzyme is coded for by a bacteriophage specific for a bacteria causing the bacterial infection , the at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria; and

b) admixing the at least one lytic enzyme with a carrier suitable for delivery of the at least one lytic enzyme to the digestive tract.

14. The composition of claim 13, wherein the carrier for delivering the at least one lytic enzyme to the digestive tract is selected from the group consisting of suppository enemas, syrups, and enteric coated pills.

15. A composition for the therapeutic or prophylactic treatment of bacterial infections of burns and wounds of the skin, comprising:

a) obtaining at least one lytic enzyme coded for by a bacteriophage specific for the bacteria causing the bacterial infections, the at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria, and

b) admixing the at least one lytic enzyme with a carrier suitable for delivery of the at least one lytic enzyme, and a carrier for suitable for delivering the at least one lytic enzyme to the skin.

16. The composition of claim 15, wherein the carrier is a bandage.

17. A method for the therapeutic or prophylactic treatment of bacterial infections of burns and wounds of the skin, comprising:

a) obtaining a composition comprising an effective amount of at least one lytic enzyme, wherein the composition is prepared by the steps of:

1) obtaining at least one lytic enzyme coded for by a bacteriophage specific for the bacteria causing the bacterial infections wherein at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria, and

2) admixing the at least one lytic enzyme with a carrier suitable for delivery of the at least one lytic enzyme to the burns and the wounds; and

b) applying the composition to a site of the burns and wounds of the skin.

18. The method of claim 17, wherein the carrier is a bandage.

19. The method of claim 17, wherein the bacteria being treated is *Staphylococcus*.

20. A method for the prophylactic and therapeutic treatment of vaginal infections, comprising:

a) obtaining a composition comprising an effective amount of at least one lytic enzyme, wherein the composition is prepared by the steps of:

1) obtaining at least one lytic enzyme coded for by a bacteriophage specific for the bacteria the at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria; and

2) admixing the at least one lytic enzyme with a carrier suitable for delivery of the at least one lytic enzyme to the vagina; and

b) applying the composition to the vagina.

21. The method of claim 20, wherein the carrier is selected from the group consisting of a tampon, pad, and douche.

22. A composition for the treatment of bacterial infection of a vagina, prepared by a process comprising the steps of:

a) obtaining at least one lytic enzyme coded for by a bacteriophage specific for the bacteria the at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria; and

b) admixing the at least one lytic enzyme with a carrier suitable for delivery of the at least one lytic enzyme to the vagina.

23. The composition of claim 22, wherein the carrier is a tampon.

24. The composition of claim 22, wherein the carrier is a douche.

25. The composition of claim 22, wherein the carrier is a pad.

26. A method for treating bacterial infections of an eye comprising the steps of:

a) obtaining a composition comprising an effective amount of at least one lytic enzyme, wherein the composition is prepared by the steps of:

1) obtaining at least one lytic enzyme wherein the at least one lytic enzyme is genetically coded for by a bacteriophage specific for the bacteria the at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria, and

2) admixing the at least one lytic enzyme with a carrier suitable for delivery of the at least one lytic enzyme, to the eye; and

b) applying the composition to the eye.

27. The method of claim 26, wherein the carrier is an eye drop solution.

28. The method of claim 26, wherein the carrier is an eye wash solution.

29. The method of claim 26, wherein the solution is an isotonic solution.

30. A composition for the treatment of a bacterial infection of the digestive tract, prepared by a process comprising the steps of:

a) obtaining at least one lytic enzyme coded for by a bacteriophage specific for the bacteria infecting the digestive tract the at least one lytic enzyme selected being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria, and

b) admixing the at least one lytic enzyme with a carrier suitable for delivery of the at least one lytic enzyme to the digestive tract.

31. The composition of claim 30, wherein the carrier is an isotonic solution.

32. A method for the prophylactic or therapeutic treatment of dermatological infections comprising:

a) obtaining a composition comprising an effective amount of at least one lytic enzyme, wherein the composition is prepared by the steps of:

1) obtaining at least one lytic enzyme wherein the at least one lytic enzyme is genetically coded for by a bacteriophage specific for bacteria causing the bacterial infections, the at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria, and

2) admixing the at least one lytic enzyme with a carrier suitable for delivery of the at least one lytic enzyme to the skin; and

b) topically applying the composition to the skin.

33. The method of claim 32, wherein the form in which the composition is delivered is selected from the group consisting of a spray, a smear, a time release patch, a liquid absorbed wipe, and any combination thereof.

34. The method of claim 32, wherein the composition further comprises at least one complementary agent which potentiates the bactericidal activity of the lytic enzyme, the complementary agent being an antibiotic.

35. A composition for treating bacterial infections of the mouth or teeth, prepared by a process comprising the steps of:

a) obtaining at least one lytie enzyme coded for by a bacteriophage specific for the bacteria causing the at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, and wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria, and

b) admixing the at least one lytic enzyme with a carrier suitable for delivery of the at least one lytic enzyme, and a carrier for suitable for delivering the at least one lytic enzyme to the mouth or teeth.

36. The composition of claim 35, wherein the carrier is selected from the group consisting of a toothpaste, an oral wash, a chewing gum and a lozenge.

37. A method for parenterally treating bacterial infections, comprising the steps of:

a) obtaining a composition comprising an effective amount of at least one lytic enzyme, wherein the composition is prepared by the steps of:

1) obtaining at least one lytic enzyme coded for by bacteriophage specific for the bacteria the at least one lytic enzyme being selected from the group consisting of chimeric lytic enzymes, shuffled lytic enzymes, and combinations thereof, wherein the at least one lytic enzyme has the ability to digest a cell of the bacteria, and

2) admixing the at least one lytic enzyme with a carrier suitable for parenterally delivering the at least one lytic enzyme, and

b) parenterally administering the composition to a site of the infection.

38. The method of claim 37, wherein the composition is administered intravenously, intramuscularly or subcutaneously.

39. The method of claim 37, wherein the composition further comprises at least one complementary agent which potentiates the bactericidal activity of the lysin enzyme, the complementary agent being an antibotic.

40. The method of claim 37, wherein the carrier comprises distilled water, a saline solution, albumin, a serum, or any combination thereof.

41. The method of claim 37, wherein the carrier further comprises DMSO.